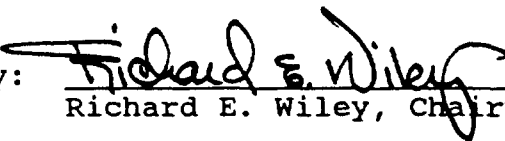


accorded to the pathfinding contributions and perseverance of the proponents whose systems are still under consideration.

Respectfully submitted,

FCC ADVISORY COMMITTEE ON
ADVANCED TELEVISION SERVICE

By: 
Richard E. Wiley, Chairman

Appendix A

ADVISORY COMMITTEE ON
ADVANCED TELEVISION SERVICE

MEMBERS

Richard E. Wiley*, Wiley, Rein and Fielding (Chairman)
Frank Biondi, Viacom International, Inc.
Joel Chaseman, Chaseman Enterprises International
Bruce L. Christensen, Public Broadcasting System
Joseph Collins, American Television Communications, Corp.
William Connolly, Sony Corporation of America
Martin S. Davis, Paramount Communications, Inc.
Barry Diller, Fox, Inc.
James C. Dowdle, Tribune Broadcasting Company
Craig I. Fields, Microelectronics and Computer Tech. Corp.
Stanley S. Hubbard, Hubbard Broadcasting
Donald F. Johnstone, Philips Consumer Electronics Corp.
James Kennedy, Cox Enterprises, Inc.
James C. McKinney, Advanced Television Systems Committee
Thomas S. Murphy, Capital Cities/ABC Inc.
Jerry K. Pearlman, Zenith Electronics Corporation
F. Jack Pluckhan, Quasar
Ward Quaal, The Ward L. Quaal Company
Richard D. Roberts, TeleCable Corporation
Burton Staniar, Westinghouse Broadcasting Corp.
Laurence Tisch, CBS, Inc.
Robert Wright, National Broadcasting Company
Joseph Flaherty*, CBS/Operations and Engineering
Irwin Dorros*, Bell Communications Research
James Tietjen*, SRI International

EX OFFICIO MEMBERS

Bradley P. Holmes, Department of State
(Vacant), NTIA/Department of Commerce
John Abel*, NAB
Wendell Bailey*, NCTA
Henry L. Baumann*, NAB
Tyrone Brown*, Steptoe and Johnson
Brenda Fox*, Representing NCTA
George Vradenburg III*, Fox, Inc.
Margita White*, MSTV
Joseph Donahue, Thomson Consumer Electronics, Inc.
Robert Graves, American Telephone and Telegraph
Keiichi Kubota, NHK
Jae S. Lim, Massachusetts Institute of Technology
Donald Rumsfeld, General Instrument Corporation

* Denotes member of Steering Committee

Appendix B

Mr. Richard E. Wiley
Chairman
Advisory Committee on Advanced Television Service
Wiley, Rein & Fielding
1776 K Street, N.W.
Washington, D.C. 20006

James E. Carnes
President and
Chief Operating
Officer

Dear Dick:

March 2, 1992

Looking ahead to the remaining challenges of selecting an Advanced Television System for the United States, we cannot help but reflect on the major and constructive changes in direction that have been cooperatively engineered through the ACATS process. As a result, the options under consideration have been dramatically reduced and are now appropriately focused on Simulcast HDTV. Through the efforts of the United States, the television and electronics communities look forward to what, in our opinion, will be a digital transmission world.

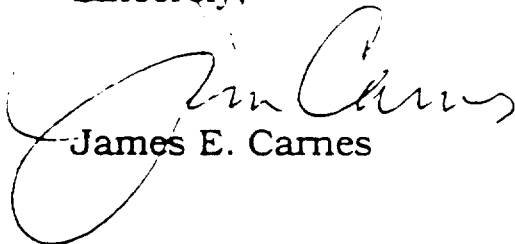
We at the ATRC are very excited about the rapid and far-reaching progress made in developing Advanced Digital HDTV. Our system is both spectrum and cost efficient; it provides excellent HDTV picture and sound quality, as well as the most reliable and robust broadcast characteristics; it also includes the most innovative attributes of scalability, extensibility and interoperability. In short, we believe our system best meets all of the criteria established by the FCC and ACATS, and we are confident that our system would allow the United States to proceed with immediate implementation of HDTV as soon as the FCC completes the standard selection process.

March 2, 1992

In view of the extraordinary progress that has been made on Digital Simulcast HDTV, and following the recommendation of FCC Chairman Sikes, we now recognize and agree that EDTV systems can best be evaluated after a Simulcast HDTV decision is made. Accordingly, on behalf of the ATRC, I request that you defer consideration of ACTV in the ACATS process and consider ACTV only after ACATS has made a recommendation on HDTV -- and even then only if considered necessary by the Advisory Committee.

Many individuals will invest a considerable amount of time evaluating the test results of the system proposals. We believe the emphasis should rightfully be placed where the maximum benefit for the United States will reside -- on digital transmission. Deferring consideration of ACTV at this time will help the process reach its goal in the quickest and most efficient way. In the event difficulties arise in the approval of an HDTV standard, we would then request reactivation of our ACTV alternative.

Sincerely,



James E. Carnes

WILEY, REIN & FIELDING

1776 K STREET, N. W.
WASHINGTON, D. C. 20006
(202) 429-7000

RICHARD E. WILEY
202 429-7000

March 5, 1992

FACSIMILE
(202) 429-7049
TELEX 248349 WYRN UP

James E. Carnes
President and Chief Operating Officer
David Sarnoff Research Center
Subsidiary of SRI International
CN 5300
Princeton, New Jersey 08543-5300

Dear Jim:

Thank you for your letter of March 2. I very much appreciate your generous comments concerning the Advisory Committee process. I also agree with the views that you express concerning our progress with regard to simulcast HDTV.

I fully accept your decision with regard to the ACTV system. The Advisory Committee thus will devote no further attention to this system unless we subsequently determine that none of the HDTV systems under consideration can or should serve as the basis for a recommendation to the FCC relative to a new television transmission standard. Specifically, ACTV will not be considered by SS/WP-4 nor by the Special Panel that I intend to recommend to the Advisory Committee at its March 24 meeting. ATRC also will not be accorded a "seat" at the Special Panel meetings except, of course, with regard to its digital HDTV system. If any future consideration of ACTV is to be initiated, it will be only at the discretion of the Advisory Committee.

In closing, let me express appreciation to you and your colleagues for the contributions you have made to the Advisory Committee. I look forward to working with you in the future. Please accept my best regards.

Sincerely yours,



Richard E. Wiley

REW:jdk

Appendix C



FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON

OFFICE OF
THE CHAIRMAN

FEB 14 1992

Mr. Richard E. Wiley
Wiley, Rein & Fielding
1776 K Street, N.W.
Washington, DC 20006

Dear Dick:

The Advisory Committee on Advanced Television Service was chartered on September 30, 1987 and held its first meeting on November 17, 1987. Since that time, the Committee, with the generous and spirited cooperation of hundreds of industry participants, has proven to be an invaluable source of information, assistance and recommendations related to the introduction and implementation of advanced television technologies. At the present pace of work, the Committee will meet its objectives by the end of this year and submit its final report to the Commission. For that reason and because of changes that have recently occurred in its membership, I thought it appropriate to take this opportunity to review the Committee's structure and procedures.

The Advisory Committee itself consists only of the 25 members chosen by the Commission to function as a Parent Committee. Although its report to the Commission may embody the work of many other parties, the advice and recommendations contained therein must reflect the judgment of those 25 members. If any matter cannot be resolved by consensus and must be put to a vote, only those 25 members are entitled to vote.

Shortly after the Advisory Committee was established, the Commission began the practice of appointing ex officio members. These members have a special role in the work of the Committee by virtue of holding office in a Federal Agency, a leadership position in a subcommittee or an executive position in a company developing an advanced television standard. Ex officio members are entitled to participate in the deliberations of the Advisory Committee and may express their views, enter into debate on the issues and offer suggestions as to any position the Committee should adopt. However, they may not participate in any vote and the Parent Committee is not obligated to embody their views in its final report.

At previous meetings we have encouraged the attendance of the members named to the Parent Committee, although we have permitted substitutes when necessary to accommodate scheduling conflicts. This is satisfactory where the Committee is only concerned with approving interim reports. However, the members were chosen because of their personal experience, expertise and position in the television industry. The final report and recommendations of the Committee must represent the opinions of the named members. Accordingly, when the Committee conducts its deliberations on its final report, active participation

Mr. Richard E. Wiley

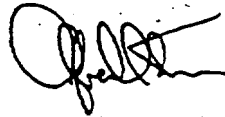
2.

in the meeting will be limited to the named members. Members who are unable to attend the meeting may submit their comments and recommendations in writing or may otherwise work with the Chairman of the Committee to ensure that their advice is conveyed to the Commission.

One final matter concerns any committee proposal to recommend a new advanced television standard to the Commission. When members were first named to the Committee in 1987, no particular standards were under consideration. Since that time, several members of the Committee have become associated with specific proposals for an advanced television standard. If the Committee finds it necessary to make a choice between standards, I will ask that members who are or were associated with the development of a particular system refrain from voting on a recommendation of the appropriate standard. This approach, I believe, is necessary to avoid the appearance of any conflict of interest and to ensure a fair, balanced and objective recommendation by the Committee.

The development of an advanced television standard is proving to be a significant and worthwhile enterprise for the United States. I look forward to working with you to bring it to fruition.

Sincerely

A handwritten signature in black ink, appearing to read 'Alfred C. Sikes', with a stylized flourish at the end.

Alfred C. Sikes
Chairman

Appendix D

SPECIAL PANEL

SS/WP4 Actions Prior to the Meeting of the Special Panel

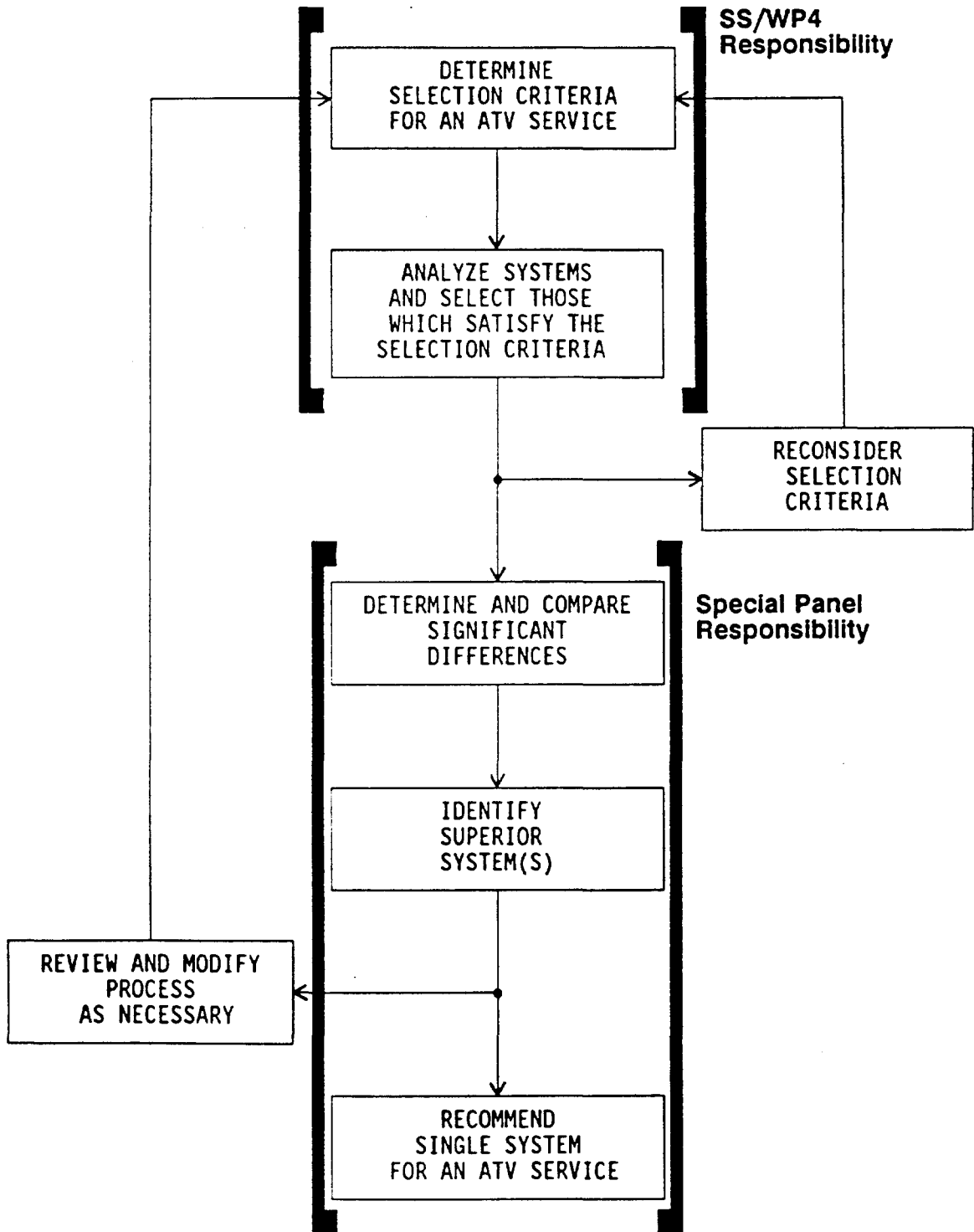
- SS/WP4 has developed a process for recommending an ATV system to the Advisory Committee (see Annex I). Part of the process will be handled by SS/WP4 and part will be left for the Special Panel.
- SS/WP4 has developed a list of ten Selection Criteria (the first step in the Recommendation Process) and their associated target values (see Annex II and Annex III). The Selection Criteria fall into three categories:
 - Spectrum Utilization
 - Technology
 - Economics
- SS/WP4 has developed an outline for the Advisory Committee system recommendation report (see Annex IV). The first six chapters will include background information and contributions from other working parties. Chapters seven and eight will contain much of the work of SS/WP4. Chapter seven will explain the Selection Criteria and their importance in the selection of an ATV system; chapter eight will contain the analysis of each proposed system. Chapter nine, which will be the responsibility of the Special Panel, will contain a comparison of proposed systems and recommendations. The remainder of the report, contributed primarily by SS/WP4 and supplemented as necessary by the Special Panel, will contain conclusions and other information regarding work which must be done in the future.
- SS/WP4 will write a report on each proposed system based on test data and economic analysis for inclusion in chapter eight of the report. The Selection Criteria will be the basis upon which each system is analyzed. (PS/WP3 will provide test analysis on Selection Criteria related to Spectrum Utilization. An SS/WP4 task force will provide test analysis on Selection Criteria related to Technology. Input on interoperability, extensibility, and scope of services will be provided by PS/WP4. SS/WP3 will provide analysis on Economics related Selection Criteria.) These reports will be written, system by system, as test data becomes available. SS/WP4 will not attempt to reach conclusions in the individual system reports but will assure that a fair and balanced report is written on each system.
- After SS/WP4 has completed its portion of the report, including the adoption of all system reports, its work will be complete.

The Special Panel Meeting

- The Special Panel will meet shortly after the last SS/WP4 meeting. Its assigned objective will be to recommend an ATV system to the Advisory Committee.
- The meeting will begin on a Monday morning in a hotel in the Washington, D.C. area, but not downtown. The meeting will be conducted in a formal manner, similar to ITU meetings (CCIR and CCITT), with controlled interventions. The meeting will be open to the public, as are all Advisory Committee meetings, but for observation only.
 - Large table with assigned seating for the participants
 - Chairs provided at the periphery of the room for observers
 - Strict, formal control of the meeting by the chairman
 - "Flags" for panelists to use to request the floor
 - Controlled interventions with the use of microphones for panelists
 - If desired, taping of the proceedings could be arranged
- Several presentations will be given on the opening day:
 - Statement of the objectives of the Special Panel
 - Final report of SS/WP4
 - Explanation of the Selection Criteria
 - Reports on each proposed system
 - Statements by each proponent
- Discussions and recommendations will be centered on identifying the system which best satisfies the Selection Criteria. The procedures shown in the Recommendation Process will be used.
 - Systems will be ranked on each Selection Criterion.
 - Inferior systems will be eliminated.
 - An overall best choice may become obvious when the performance of all systems has been ranked according to each Selection Criterion.
 - If no single winner becomes apparent, the relative importance of the Selection Criteria will be determined by the Panel.
 - If more than one choice continues to exist, the Panel will develop rationale for why each choice might be adopted by the FCC. The Panel will also list the disadvantages of each choice.
 - The goal of the meeting will be to reach consensus on an ATV system to be recommended to the Advisory Committee.
- Drafting groups will be assigned tasks as the meeting progresses. All text, including recommendations, will be approved by the full Panel.

- The meeting will not conclude until the work is complete (including the week-end if the work is not complete Friday afternoon). All text prepared during the meeting will be adopted during the meeting — there will be no "after-the-fact" approvals by the Panel.
- The report of the Special Panel will go directly, and immediately, to the Advisory Committee for consideration.

RECOMMENDATION PROCESS



SELECTION CRITERIA

Spectrum Utilization

Coverage Area

Accommodation Percentage

Economics

Cost to Broadcasters

Cost to Alternative Media

Cost to Consumers

Technology

Audio/Video Quality

Transmission Robustness

Scope of Services and Features

Extensibility

Interoperability considerations

Target Values for the Selection Criteria

SS/WP4 has identified ten criteria to be used in recommending an advanced television system. Target values are being developed to represent the target level of performance aspired to in an advanced television system. These target values do not represent minimum criteria that tested systems are expected to exceed. The ten selection criteria and associated target values are:

Coverage area — Comparable to NTSC.

Accommodation percentage — 100% of currently authorized full service stations and pending applications for full service stations. It is desirable to accommodate all noncommercial vacant allotments.

Audio/video quality — The CCIR has defined HDTV in terms of current television systems. That definition, applied to NTSC, leads to the following target value. The resolution should be about twice that of NTSC in both the vertical and horizontal directions, the temporal resolution should not be less than NTSC, the color rendition should be superior to NTSC, any artifacts should be less objectionable than are NTSC artifacts, the aspect ratio should be 16:9, and the subjective sound quality should be comparable to compact disc.

Transmission robustness — Better than NTSC within the defined coverage area.

Scope of services and features — When compared with NTSC, increased capability and flexibility in the ability to provide audio, captioning, data services, etc.

Extensibility — A new service must provide long life, just as NTSC has provided a long life, by supporting future enhancements and future technology advances.

Interoperability — A new service should be "friendly" to alternate delivery media. Interoperability with Cable TV is mandatory. Interoperability with VCRs, satellite, computer, data communications, and telecommunications applications with simple interfacing hardware is also an objective.

Cost to broadcasters

Cost to alternative media

Cost to consumers

It is difficult to establish target values for cost issues. Furthermore, cost is a function of market conditions and production volume. Key issues for broadcasters and cable operators would be the cost to "pass" programming. Key issues for consumers would be the cost of a receiver and a VCR after five years of production. In the SS/WP4 final report, it may be reasonable to point out the cost of current top-of-the-line NTSC projection receivers and top-of-the-line VCRs for reference as base-line costs, but not as target values.

**FCC ADVISORY COMMITTEE ON ADVANCED TELEVISION SERVICE
SYSTEMS SUBCOMMITTEE
WORKING PARTY ON SYSTEM STANDARDS (SS/WP4)**

OUTLINE FOR REPORT

- 1. Executive Summary**
- 2. Introduction**
- 3. Background and History**
- 4. Contributions from the Planning Subcommittee**
 - 4.1. WP1 — Working Party on Technology Attributes and Assessment
 - 4.2. WP2 — Working Party on Testing and Evaluation Specifications
 - 4.3. WP3 — Working Party on Spectrum Utilization and Alternatives
 - 4.4. WP4 — Working Party on Alternative Media Technology and BC Interface
 - 4.5. WP5 — Working Party on Economic Factors and Market Penetration
 - 4.6. WP6 — Working Party on Systems Subjective Assessment
 - 4.7. WP7 — Working Party on Audience Research
 - 4.8. AG1 — Advisory Group on Creative Issues
 - 4.9. AG2 — Advisory Group on Consumer/Trade Issues
- 5. Contributions from the Systems Subcommittee**
 - 5.1. WP1 — Working Party on Systems Analysis
 - 5.2. WP2 — Working Party on Testing and Evaluation
 - 5.2.1. ATTC Report
 - 5.2.2. CableLabs Report
 - 5.2.3. ATEL Report
 - 5.2.4. Field Test Report
 - 5.3. WP3 — Working Party on Economic Assessment
 - 5.4. WP4 — Working Party on System Standards
- 6. Contributions from the Implementation Subcommittee**
 - 6.1. WP1 — Working Party on Policy and Regulation
 - 6.2. WP2 — Working Party on Transition Scenarios

7. Selection Criteria

- 7.1. Introduction
- 7.2. Spectrum Utilization Criteria
 - 7.2.1. Background
 - 7.2.2. Coverage Area
 - 7.2.3. Accommodation Percentage
- 7.3. Economics Criteria
 - 7.3.1. Background
 - 7.3.2. Cost to Broadcasters
 - 7.3.3. Cost to Alternative Media
 - 7.3.4. Cost to Consumers
- 7.4. Technology Criteria
 - 7.4.1. Background
 - 7.4.2. Audio/Video Quality
 - 7.4.3. Transmission Robustness
 - 7.4.4. Scope of Services and Features
 - 7.4.5. Extensibility
 - 7.4.6. Interoperability Considerations

8. Analysis of System Data

- 8.1. System A
 - 8.1.1. Policy and Regulatory Issues
 - 8.1.2. Spectrum Utilization
 - 8.1.3. Economics
 - 8.1.4. Technology
- 8.2. System B
 - 8.2.1. Policy and Regulatory Issues
 - 8.2.2. Spectrum Utilization
 - 8.2.3. Economics
 - 8.2.4. Technology
- 8.3. System C
 - 8.3.1. Policy and Regulatory Issues
 - 8.3.2. Spectrum Utilization
 - 8.3.3. Economics
 - 8.3.4. Technology
- 8.4. Other Sections as necessary (one per system)

9. Comparisons and Recommendations

**Special Panel
Responsibility**

- 9.1. System Comparison
 - 9.1.1. Policy and Regulatory Issues
 - 9.1.2. Spectrum Utilization
 - 9.1.3. Economics
 - 9.1.4. Technology
- 9.2. Recommendations
 - 9.2.1. Policy and Regulatory Issues
 - 9.2.2. Spectrum Utilization
 - 9.2.3. Economics
 - 9.2.4. Technology

10. Implementation Plan

11. Future Work

- 11.1. Development of Standards

12. Conclusions

13. Notes and Comment

14. Bibliography

15. Acknowledgements

Appendices

- A1. Raw Data
- A2. Methods of Data Reduction
- A3. Glossary

Annex V of Appendix D

Advisory Committee on Advanced Television Service

Special Panel Participants

Advisory Committee Leaders

1. Robert Hopkins (<u>Chair</u>)	SS/WP-4	ATSC
2. Joseph Flaherty	PS	CBS
3. Irwin Dorros	SS	Bellcore
4. George Vradenburg III	IS	Fox
5. Renville McMann	PS/WP-1	Consultant
6. Dale Hatfield	PS/WP-3	Consultant
7. Edward Horowitz	PS/WP-4	Viacom
8. Rupert Stow	PS/WP-5	Consultant
9. Craig Tanner	PS/WP-6	CableLabs
10. Richard Ducey	PS/WP-7	NAB
11. Birney Dayton	SS/WP-1	N-Vision
12. Mark Richer	SS/WP-2	PBS
13. Larry Thorpe	SS/WP-3	Sony America
14. Charles Jackson	IS/WP-1	National Economic Research Associates

Advisory Committee Members At Large

15. Wendell Bailey	Vice Chair, PS	NCTA
16. John Barry	Vice Chair, PS/AG-2	IBEW
17. Alex Felker (<u>Vice Chair</u>)	Former Chief, FCC Mass Media Bureau	Time Warner
18. James Gaspar	PS/WP-6, SS/WP-4	Panasonic
19. Branko Gerovac	PS/WP-4	DEC
20. George Hanover	Vice Chair, SS/WP-2	EIA
21. Bronwen Jones	Vice Chair, PS/WP-6	Consultant
22. Robert Niles	Vice Chair, PS/WP-1	Capital Cities/ABC
23. Robert Sanderson	Vice Chair, PS/WP-4	Eastman Kodak
24. Richard Stumpf	PS/AG-1	Universal City Studios
25. Victor Tawil	PS/WP-3, SS/WP-4	MSTV

Ex-Officio Participants

- FCC Staff; Other U.S. Government Representatives
- HDTV System Proponent Representatives (one per testing slot)
- Test Center Representatives
- Field Test Technical Oversight Committee Representative
- Canadian Liaison
- Richard Wiley, Chairman, Advisory Committee

Appendix E

FIELD TEST TECHNICAL OVERSIGHT COMMITTEE

Chairman:	1.	Richard Wiley	Wiley, Rein & Fielding
Vice-Chair:	2.	Joel Chaseman	Chaseman Enterprises
Members:	3.	Wendell Bailey	NCTA
	4.	Alex Best	Cox Cable
	5.	Jules Cohen	Consultant
	6.	Birney Dayton	N-Vision
	7.	Irwin Dorros	Bellcore
	8.	Alex Felker	Time Warner
	9.	Joseph Flaherty	CBS
	10.	George Hanover	EIA
	11.	James McKinney	ATSC
	12.	Renville McMann	Consultant
	13.	Howard Miller	PBS
	14.	Robert Niles	Capital Cities/ABC
	15.	Michael Rau	NAB
	16.	Henry Rivera	Ginsburg Feldman
	17.	Andrew Setos	Fox
	18.	Peter Smith	NBC
	19.	Craig Tanner	CableLabs
	20.	Bud Williamson	MSTV

Ex-Officio:	-	FCC Representatives
	-	Proponent(s) representative(s)
	-	Mark Richer (PBS; Executive Management for ATV Field Testing)
	-	Ed Williams, Manager, ATV Field Test Project

Appendix F

Review of Technology

An Evaluation of Additional ATV Systems and Techniques

I. INTRODUCTION

In November 1990, the Advisory Committee, the ATTC, and the CableLabs entered into a Memorandum of Understanding ("MOU") with the FCC that would formalize the government-industry partnership to develop a terrestrial ATV standard. Among other things, the MOU requires that the Advisory Committee review the state of technology to identify whether there exist any

new technical advancements in the state of the art, not already provided by the ATV systems pre-certified by the Advisory Committee, that appear to offer important benefits to the public and are sufficiently concrete so as to be tested contemporaneously with the pre-certified systems.²⁵

To comply with this requirement, the Chairman of the Advisory Committee requested the Planning Subcommittee to investigate ATV proposals other than those systems certified for testing, and determine whether any were sufficiently concrete. This investigation was conducted by the Chair of PS/WP-1 in consultation with the Chair of SS/WP-1.

²⁵ MOU, November 14, 1990, at p. 3. The MOU further required that the Advisory Committee, by early 1992, prepare a report and recommendation to the Commission on whether any of these new developments should be tested. *Id.* at pp. 3-4.

II. NEW TECHNIQUES

All of the digital ATV systems submitted to the Advisory Committee for system analysis, certification, and testing are based on discrete cosine transform (DCT) technology. Other techniques are under study and were investigated for possible inclusion in the Advisory Committee's work.

A. Wavelets

A method of achieving video data compression known as "wavelets" is being researched by Columbia University and others. A wavelet-based compression system would develop a transmitted picture from a series of equations representing gradually higher resolution components (the "waves") so that, by properly arranging the digital transmission signal, the reduction in picture quality with increasing distance from the transmitter would be gradual, rather than abrupt. Thus, fringe areas would receive a lower resolution picture instead of suddenly receiving no picture at all. It should be noted that several of the proposed systems certified for testing, all of which use DCT, also claim a gradual fringe area fall-off in picture quality.

B. Fractals

Another technique, is being studied by the Georgia School of Technology and Iterated Systems, Inc., and others, is the application of "fractals." This compression technique relies on fundamental equations, called fractals, in the encoding/decoding

algorithms. These equations, first demonstrated by Mandelbrot of MIT in the late 1970's, require less bandwidth to transmit than other transforms. Compression ratios of more than 1000 to 1 have been reported. One problem of the fractal technique is in generating the correct fractal equations at the encoder. Although this difficulty can be overcome with sufficient computing power, hardware available at present takes several seconds to generate a single frame of the image.

C. Vector Quantization

Another non-transform compression technique is called "Vector Quantization." With this technique, a block of picture elements is used to form either a 2D or 3D vector, and the image is examined at the encoder to determine which vectors, out of a large universe, are most likely to follow. The difficulty with vector quantization lies in selecting a small enough group of vectors to achieve adequate compression while also achieving adequate picture quality. Scientific Atlanta has demonstrated vector quantization for NTSC quality pictures, but has not publicly done so for HDTV.

III. THE E3TV SYSTEM

In January 1992, the Scabbard Corporation announced that it is working on a new system, called "E3TV," with over 2000 lines of resolution. A very brief summary of this technology has been submitted to SS/WP-1. Scabbard plans to use a new type of camera

sensor combined with unique signal processing. Although development has just begun, Scabbard has informed Advisory Committee personnel that it expects to have prototypes available by July, 1992.

IV. CONCLUSION

Although the techniques and systems described above have been publicly discussed by their respective proponents, none has apparently reached the stage where it can be submitted to SS/WP-1 for system analysis and test certification. Computer simulation of short sequences of material cannot be substituted for hardware capable of real-time ATV testing at the test centers, and none of the new systems appears to have such hardware available. Thus, at present, no new technical advancements are "sufficiently concrete so as to be tested contemporaneously with the [pre-] certified systems," and no additional ATV systems have been submitted for consideration in accordance with the Advisory Committee's procedures and schedule.